

This exam is **closed book**. You can have **one sheet** (i.e., **two pages**) of notes.
Please be specific and answer every part of every question.

1. Give a *disadvantage* of:
 - (a) *Mapped files*? (5 points)
 - (b) *Partial subblocking*? (5 points)
 - (c) Using the *valid bit* to replace a missing *page reference bit*? (5 points)
2. Consider a cache managed by an ARC replacement policy and assume that the size of **T1** is lesser than **target_T1**. Which actions will be taken by the ARC policy when the cache is full and the next cache miss is caused by a page that is
 - (a) *Neither in B1 nor in B2*? (5 points)
ARC will expel the least frequently referenced page from __ **T1** __ **T2**.
It will __ increase **target_T1** __ decrease it __ leave it unchanged.
 - (b) *In B2*? (5 points)
ARC will expel the least frequently referenced page from __ **T1** __ **T2**.
It will __ increase **target_T1** __ decrease it __ leave it unchanged.
3. Describe in some detail the page replacement policy of Mach (10 points minus 4 points if no diagram) and explain its main advantage and main disadvantage over the VMS page replacement policy (2×5 points)
4. Why did Babaoglu and Joy introduce the **vfork()** system call? (5 points) Why did it never replace the **fork()** system call? (5 points)
5. What is false sharing? (5 points) What problem does it cause in a DSM? (5 points) How does Munin address this issue? (5 points)
6. How does Mach implement threads? (5 points)
7. Why does the Fast File System subdivide each disk partition into cylinder groups? (5 points)
8. Unlike Windows, UNIX typically merges all its disk partitions into a single directory hierarchy. What is the main advantage of this approach? (5 points) Which mechanism does UNIX use to implement it? (5 points)
9. What would be the best page table organization for a virtual memory system with a 4 KB page size and a TLB that uses *complete subblocking* with a subblocking factor of 2. (10 points including 5 points for a detailed drawing of a page table entry).